PROCEEDINGS
OF
THE ROYAL SOCIETY.

1841. No. 47.

March 4, 1841.

MAJOR SABINE, R.A., V.P., in the Chair.

Robert William Sievier, Esq., was balloted for, and duly elected into the Society.

A paper was read, entitled, "Miscellaneous Observations on the Torpedo." By John Davy, M.D., F.R.S.

The experiments described in this paper were made on a single fish, of middle size, recently taken out of the water. Portions of the electrical organs, cut transversely in thin slices, exhibited under the microscope many elliptical particles, apparently blood-corpuscles, the long diameter of which was about 1-800th, and the short about 1-1000th of an inch, and a few filaments, apparently nervous, irregularly scattered; some of them tortuous, and all about the 2000th of an inch in diameter. The latter bore no resemblance to muscular fibres. The blood contained some globular particles, having a diameter of the 4000th of an inch, mixed with the elliptical. The mucus for lubricating the surface was found to contain globules apparently homogeneous in substance, but of irregular outline, and in size varying from the 2000th to the 270th of an inch.

A paper was also read, entitled, "On a remarkable property of the Diamond." By Sir David Brewster, K.H., D.C.L., F.R.S.L., V.P.R.S. Ed.

On re-examining the phenomena of parallel bands of light and shade exhibited by reflexion at the plane surface of a diamond, which the author had noticed some years ago, he concludes that they result from the reflexions of the edges of veins or laminæ, of which the visible terminations are inclined at different angles, not exceeding two or three seconds, to the general surface. He gives an account of several analogous facts observable in other crystals, more especially those of carbonate of lime, artificially polished in surfaces inclined to the natural planes of cleavage.

March 11, 1841.

Sir JOHN WILLIAM LUBBOCK, Bart., V.P. and Treasurer, in the Chair.

The following papers were read:

1. "On a Cycle of Eighteen Years in the Mean Annual Height of the Barometer in the Climate of London; and on a Constant Variation of the Barometrical Mean, according to the Moon's Declination." By Luke Howard, Esq., F.R.S.

For obtaining the general results communicated in the present paper, the author has followed the same method as that he had adopted in the two former papers laid before the Society on the connexion of the barometrical variation with the lunar phases and apsides. Tables are given of the barometrical averages on successive solar years, from 1815 to 1832, so constructed as to exhibit the variation of the moon's influence according to her declination; and also of these averages on successive cycles of nine solar years, classed according to the moon's place in declination, on either side of the equator. The results deduced from these comparisons are, first, that the barometrical mean in this climate is depressed by the moon's declination being to the south of the equator; and, secondly, that this depression takes place gradually, commencing with the moon's being in full north declination, and proceeding through her remaining positions to the time when she crosses the equator to resume the northern declination; at which season, the whole pressure that had been withdrawn from the atmosphere is suddenly restored. The author thinks there is evidence of a great tidal wave, or swell in the atmosphere, caused by the moon's attraction, preceding her in her approach to, and following her slowly as she recedes from these latitudes; so that were the atmosphere a calm fluid ocean of air, of uniform temperature, this tide would be manifested with as great regularity as those of the ocean of waters. But the currents uniformly kept up by the sun's varying influence effectually prevent this from taking place, and involve the problem in complexity. He finds that there is also manifested in the lunar influence a gradation of effect, which operates through a cycle of eighteen years. The mean pressure of the atmosphere during the first part of this period increases; and then, after preserving for a year its maximum amount, again decreases through the remaining years of the cycle, but exhibits, towards its minimum, some fluctuations before it again regularly increases.

2. "On a remarkable depression of the Barometer in November 1840, agreeing very closely in its movements and results with that of December 1821." By Luke Howard, Esq., F.R.S.

The object of the author in the present paper is to show the close correspondence of the extraordinary depression of the barometer in the months of October and November of last year (1840), and of the remarkably stormy weather which prevailed at the same period, with similar phenomena occurring in December 1821, when the moon's place in declination underwent the same changes during those two periods, at an interval of nineteen years.

3. "General results of Meteorological Observations at Constantinople." By J. W. Redhouse, Esq. Communicated by John Davy, M.D., F.R.S.

4. "Term-Observations made at Prague in November and December 1840, and January 1841." By C. Kreil. Communicated by S. Hunter Christie, Esq., M.A., Sec. R.S.

March 18, 1841.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

The Right Hon. Thomas Frankland Lewis, and Robert Masters Kerrison, M.D., were balloted for, and severally elected into the Society.

The following Magnetical and Meteorological Observations, taken in conformity with the Report drawn up by the Committee of Physics including Meteorology, for the guidance of the Antarctic Expedition, as also for the various fixed Magnetic Observatories, have been communicated by the Lords Commissioners of the Admiralty, and by the Master-General of the Ordnance, viz.—

1. "Magnetic-term Observations, taken at Kerguelen's Land, for May and June 1840." By Capt. James Clark Ross, R.N., F.R.S., Commander of the Expedition.

2. "Hourly Magnetic Observations taken at Kerguelen's Land, commencing May 25, and ending June 27, 1840." By Capt. James Clark Ross, R.N., F.R.S., &c.

3. "Meteorological Observations taken on board Her Majesty's Ship *Erebus*, for October, November, and December 1839, and from January to August 1840." By Capt. James Clark Ross, R.N., F.R.S., &c.

4. "Meteorological Observations taken on board Her Majesty's Ship *Terror*, for November and December 1839, and from January to July 1840." By Capt. T. B. M. Crozier, R.N.

5. A paper was also in part read, entitled, "On the Localities affected by Hoar-frost, the peculiar currents of Air excited by it, and the Temperature during its occurrence at High and Low Stations." By James Farquharson, LL.D., F.R.S., Minister of the Parish of Alford.

March 25, 1841.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

The following communications were read, viz.—

1. The reading of a paper entitled, "On the Localities affected by Hoar-frost, the peculiar currents of Air excited by it, and the Temperature during its occurrence at High and Low Stations." By James Farquharson, LL.D., F.R.S., Minister of the Parish of Alford, was resumed and concluded.

The author states that he has been accustomed, for the last forty years, to make observations on the occurrence of hoar-frost, and the circumstances under which it takes place, with a view of obtaining a correct explanation of the causes of that phenomenon. It is well-known, he observes, that the localities chiefly affected with hoar-frost are the bottoms of valleys, and land-locked places of all kinds, whether natural or artificial. The altitude to which its effects reach on the sides of the valleys is dependent on the mean temperature of the day and night at the time of its occurrence: when that temperature is high, the lower places only are affected by the frost; but when low, the frost extends to much higher grounds. Hoar-frost occurs only during a calm state of the air, and when the sky is clear; but the stillness of the air in the bottoms of the valley is invariably accompanied by downward currents of air along all the sloping sides of the valley; and it is to this fact, first noticed by the author, that he wishes more particularly to direct the attention of the Society, as affording a decisive proof of the correctness of the views he entertains, being in accordance with the theory of Dr. Wells. He finds that after sunset, in all seasons of the year, and at all mean temperatures of the air, and whether or not the ground be covered with snow, whenever the sky is clear, although there may be a dead calm at the bottoms of the valleys, currents of air, more or less strong and steady, run downwards on the inclined lands, whatever may be their aspect with reference to the points of the compass. These currents are the result of the sudden depression of temperature sustained by the surface of the earth in consequence of rapid radiation, by which the stratum of air in immediate contact with that surface, becoming specifically heavier by condensation, descends into the valley, and is replaced by air which has not been thus cooled, and which therefore prevents the formation of hoar-frost on the surface of these declivities.

2. "Term-Observations of Magnetic Observations, the Variation of the Magnetic Declination, Horizontal Intensity and Inclination at Prague; for June, July, September, and October 1840." By Prof. Kreil. Communicated by S. Hunter Christie, Esq., Sec. R.S.

3. "Term-Observations of the Variation of the Magnetic Declination, Horizontal Intensity and Inclination at Milan; for June 1840." By Francesco Carlini, For. Memb. R.S., Director of the Observatory.

4. "On Ground-gru, or ice formed, under peculiar circumstances, at the bottom of running water." By James Farquharson, LL.D., F.R.S., Minister of the Parish of Alford.

The author brings forward in this paper several recent observations on the formation of ice at the bottom of rivers, the conditions of which corroborate the views regarding the cause of that phenomenon, which he presented in a paper on this subject, published in the Philosophical Transactions for 1835 (p. 329), namely, that it occurs in consequence of the loss of heat by radiation from the bottom of the water, in a manner precisely analogous to the formation of hoar-frost on the surface of dry land, as first explained by Dr. Wells. He then answers some of the objections to that theory propounded in an article, under the title of GROUND-GRU, in the Penny Cyclopædia, and shows that those objections are founded in error, and possess no validity.

5. "Meteorological Observations made at the Magnetic Observatory at St. Helena, from February to October 1840." By Lieut. J. H. Lefroy, R.A.

6. "Meteorological Observations made at the Magnetic Observatory at Toronto, Upper Canada, from January to October 1840." By Lieut. E. J. B. Riddell, R.A.

7. "Observations on Magnetic Direction and Intensity made at the Observatory at Milan during the 24th, 26th and 27th of January 1841." By Prof. Carlini.

8. "Note on an irregularity in the Height of the Barometer, of which the argument is the Declination of the Moon." By Sir John William Lubbock, Bart., V.P. and Treas. R.S.

In the Companion to the British Almanac for 1839, the author inserted some results which were obtained with a view of ascertaining the influence of the moon on the barometer and on the dew-point. Mr. Luke Howard's researches on this subject having recalled his attention to that paper, he found that some of the results he had given appeared to indicate that the moon's position in declination influences the barometer. In order to render this more manifest, he combines in the present paper all the observations he gave in the Companion to the British Almanac in three categories. These observations correspond to different angular distances of the moon from the sun, or times of transit; but as the inequality of the ocean, of which the argument is the moon's declination, is independent, or very nearly so, of the time of the moon's transit, it is probable that so also is that in the height of the barometer. In this case we may with propriety combine in the same category observations which correspond to similar declinations, although to different times of transit. The results stated by the author seem to indicate an elevation of nearly one-tenth of an inch for 17 degrees of declination.

The inequality has a contrary sign to the inequality of the same argument in the tides of the ocean.

April 1, 1841.

The MARQUIS of NORTHAMPTON, President, in the Chair.

Bartholomew Parker Bidder, Esq., and Julian Jackson, Esq., were balloted for, but not elected into the Society.

The following letter, addressed to the President, was read:—

" 4, Trafalgar Square,
London, March 25th, 1841.

" My Lord,—I have the honour of transmitting to Your Lordship for presentation to the Royal Society, an original portrait of *Sir Isaac Newton* by *Vanderbank*, a Dutch painter of some note in that age.

" This picture has now been many years in my possession, and the tenure by which I have kept it (as a collateral descendant of so illustrious a man) was too flattering not to have been a source of great personal gratification.

" But I consider such a portrait to belong of right to the scientific world in general, and more especially to that eminently distinguished Society of which Newton was once the head, and which is now so ably presided over by Your Lordship.

" I have, therefore, to request Your Lordship will do me the honour to present this original portrait of Sir Isaac Newton to the Royal Society in my humble name.

" Accident having destroyed some of the papers of my family, I am unable of myself to trace the entire history of this portrait, but I believe more than one member of the Royal Society is competent to do so, and it is well known to collectors; and a small mezzotinto engraving of it was published about forty years ago. It was painted the year before Newton died, and came into the family of the celebrated Lord Stanhope, who left it by his will to my grandfather, the late Dr. Charles Hutton, a distinguished member of the Royal Society, expressly on the well-authenticated account of that eminent mathematician having been remotely descended from Sir Isaac Newton, in the following way, as I find on a family manuscript; viz. 'that the mother of the well-known James Hutton and the mother of Dr. Charles Hutton were sisters; and the grandmother of James Hutton and the mother of Sir Isaac Newton were also sisters.'

" I have ever considered this very distant connexion with so great a man should not be an inducement to lead me into any but casual mention of the circumstance, that I might avoid the imputation of a vain boast; nor would it have been brought forward now, except to explain the cause by which this portrait came into the possession of an individual who is happy in relinquishing it to grace the Hall of Meeting of the Royal Society.

"I have the honour to subscribe myself,
"Your Lordship's very obedient humble Servant,
"Charles Vignolles."

"*The Right Honourable the Marquess of Northampton,*
&c. &c. &c.
President of the Royal Society."

The following papers were read, viz.—

1. "A Meteorological Journal for 1840, kept at Allenheads, Northumberland, with a few remarks on the Rain-gauge." By the Rev. W. Walton, F.R.S.

The author shows that if the mouth of a rain-gauge be placed in any plane which is not perfectly horizontal, the results will be liable to inaccuracy, whatever may be the direction in which the rain falls. He thinks that, on many occasions, the drops of rain diminish in their size during their descent on entering warmer regions of the atmosphere, so as finally to disappear.

2. "The Scholar's Lute among the Chinese." By — Lay, Esq. Communicated by S. H. Christie, Esq., Sec. R.S.

The Kin, which is the stringed instrument here described, was the one played upon by Confucius and the sages of antiquity, and is therefore held sacred by men of letters. It is made of the Woo-tung, or *Dryandria cordifolia*. It is convex above and plane below, and is wider at one end than at the other; it has two quadrangular apertures in the plane surface, which open into as many hollows within the body of the instrument: and it is furnished with seven silken strings of different diameters, which pass over the smaller end, and are distributed between two immovable pegs below. A bridge within a short distance of the wider extremity gives these strings the necessary elevation and a passage to the under surface, where, by means of a row of pegs, they are tightened or relaxed at pleasure. The length of the sounding-board is divided by thirteen studs of nacre, or mother-of-pearl, as a guide for the performer; and they are placed so that the length of each string is bisected, trisected, &c., that is, divided into aliquot parts as far as the eighth subdivision, with the omission of the seventh, the number of sections being represented by the arithmetical series

2, 3, 4, 5, 6, 0, 8.

Thus the intervals, or magnitudes of the different tones sounded by this instrument, do not accord with those produced on our violin, but agree more with the old Scotch music. The study of this instrument, and the art of playing upon it, are rendered extremely difficult by the complexity of the Chinese notation of written music, which leads to frequent omissions and blunders. Thus every air which a Chinese plays has cost him the labour of many months to learn; and so tiresome is this acquisition, that the author has heard some extemporize very prettily without being able to play a single air. Their performance, however, is very graceful; and though the melody be simple, every scope is given to variety by the mode of touching the strings. The author enters into an examination of the musical theory of the sounds produced by this instrument.

The Society then adjourned over the Easter Recess, to meet again on the 22nd instant.

April 22, 1841.

The MARQUIS of NORTHAMPTON, President, in the Chair.

William Bowman, Esq., was balloted for and duly elected into the Society.

The following papers were read, viz.—

1. Magnetic-term Observations taken on board H.M.S. Erebus and Terror, at Hobart Town, on the 29th and 30th August, and the 23rd and 24th September, 1840, by, and under the direction of James Clark Ross, Captain R.N., F.R.S., and Commander of the Antarctic Expedition.

2. Magnetic-term Observations made at the fixed Magnetic Observatory, Van Diemen's Land, on the 28th, 29th and 30th August, and the 23rd and 24th September, 1840; by James Clark Ross, Captain R.N., F.R.S., Commander of the Antarctic Expedition.

3. Hourly Magnetic Observations for August and September, 1840, taken at the Ship's Magnetic Observatory, Van Diemen's Land, under the direction of James Clark Ross, Captain R.N., F.R.S., Commander of the Artarctic Expedition.

The above papers were communicated by the Lords Commissioners of the Admiralty.

4. Variation de la déclinaison, intensité horizontal et inclinaison magnétique, observés à Milan, pendant vingt-quatre heures de suite, le 24 et 25 Fevrier et Mars, 1841, par Signior Carlini, Forn. Memb. R.S.

5. "Remarks on the Birds of Kerguelen's Land." By R. M^{c}Cormick, Esq., Surgeon R.N. of H.M.S. Erebus. Communicated by the Lords Commissioners of the Admiralty

The birds usually met with by the author in this island were petrels and penguins; and besides these, he found two species of gull, a duck, a shag, a fern, a small albatros, and a species of Chionis; and also a remarkable nocturnal bird allied to the Procellaria. Brief notices are given of the forms and habits of these birds.

6. "Geological Remarks on Kerguelen's Land." By R. M^cCormick, Esq., Surgeon R.N. of H.M.S. Erebus. Communicated by the Lords Commissioners of the Admiralty.

The northern extremity of the island is described as being entirely of volcanic origin. The trap rocks, of which the headlands are composed, form a succession of terraces nearly horizontal. Basalt is the prevailing rock: it assumes the prismatic form, and passes into greenstone, and the various modifications of amygdaloid and porphyry. The general direction of the mountain-ranges inclines to the south-west and north-east, and they vary in height from 500 to 2500 feet. Many of the hills are intersected by trap dykes, usually of basalt. Several conical hills, with crater-shaped summits, are found, evidently the remains of volcanic vents. Three or four very singular isolated hills, composed of an igneous slaty sandstone, occur in Cumberland Bay, presenting very smooth outlines, and consisting of piles of broken fragments, through which the mass protrudes, in places, in prismatic columns. Vast quantities of *débris* are accumulated at the base of the hills, in many places to the height of 200 or 300 feet or more, affording strong evidence of the rapid disintegration this land is undergoing, from the sudden atmospheric vicissitudes to which it is exposed.

The whole island is deeply indented by bays and inlets, and its surface intersected by numerous small lakes and water courses. These, becoming swollen by the heavy rains, which alternate with frost and snow, rush down the sides of the mountains and along the ravines in countless impetuous torrents, forming, in many places, beautiful foaming cascades, wearing away the rocks, and strewing the platforms and valleys below with vast fragments of rocks and slopes of rich alluvium, the result of their decomposition.

The most remarkable geological feature in the island is the occurrence of fossil wood and coal, and what is still more extraordinary, these are imbedded in the igneous rocks. The wood, which is for the most part highly silicified, is found enclosed in the basalt; whilst the coal crops out in ravines, in close contact with the overlying porphyritic and amygdaloidal greenstone.

A few outline sketches of the rocks and scenery, in various parts of the island, accompany this paper.

A paper was also in part read, entitled, "On the proportion of the prevailing Winds, the mean Temperature, and depth of Rain in the climate of London, computed through a cycle of eighteen years, or periods of the Moon's Declination." By Luke Howard, Esq., F.R.S.

April 29, 1841.

Sir JOHN WILLIAM LUBBOCK, Bart., V.P. and Treasurer, in the Chair.

The Right Honourable Lord Monteagle, the Right Honourable Earl de Grey, the Right Honourable Lord Wrottesley, and Charles Woodward, Esq., were balloted for and duly elected into the Society.

The following papers were read, viz.—

1. "On the proportions of the prevailing Winds, the mean Temperature, and depth of Rain in the climate of London, computed through a cycle of eighteen years, or periods of the Moon's Declination." By Luke Howard, Esq., F.R.S., was resumed and concluded.

In this paper the author investigates the periodical variations of the winds, rain and temperature, corresponding to the conditions of the moon's declination, in a manner similar to that he has already followed in the case of the barometrical variations, on a period of years extending from 1815 to 1832 inclusive. In each case he gives tables of the average quantities for each week, at the middle of which the moon is in the equator, or else has either attained its maximum north or south declination. He thus finds that a north-east wind is most promoted by the constant solar influence which causes it, when the moon is about the equator, going from north to south; that a south-east wind, in like manner, prevails most when the moon is proceeding to acquire a southern declination; that winds from the south and west blow more when the moon is in her mean degrees of declination, going either way, than with a full north or south declination; and that a north-west wind, the common summer and fair weather wind of the climate, affects, in like manner, the mean declination, in either direction, in preference to the north or south, and most when the moon is coming north.

He finds the average annual depth of rain, falling in the neighbourhood of London, is 25·17 inches.

From his observations on the temperature, he deduces the following conclusions:—1. That the pressure of an atmospheric tide, which attends the approach of the moon to these latitudes, raises the mean temperature 0·35 of a degree. 2. That the rarefaction under the moon in north declination lowers the temperature 0·13 of a degree. 3. That the northerly swell following the moon as she recedes to the south further cools the air 0·18 of a degree. 4. That this cold continues while the moon is away south, reducing the mean temperature yet lower by 0·04 of a degree.

2. "A new Method of solving Numerical Equations." By Mr. Thomas Weddle, of Stamfordham. Communicated by S. H. Christie, Esq., M.A., Sec. R.S.

The object of this paper is to develope a new and remarkably simple method of approximating to the real roots of numerical equations, which possesses several important advantages. After describing the nature of the transformations which are subsequently employed, the author proceeds to develope the process he uses for obtaining one of the roots of a numerical equation. Passing over the difficult question of determining the limits of the roots, he supposes the first significant figure (R) of a root to have been ascertained, and transforms the proposed equation into one whose roots are the roots of the original, divided by this figure $\left(\text{or } \frac{x}{R}\right)$: one root of this equation lying between 1 and 2, the first significant figure (r) of the decimal part is obtained, and the equation transformed into another whose roots are those of the former, divided by 1 + this decimal (or $1+r$). This last equation is again similarly transformed; these transformations being readily effected by the methods first given. Proceeding thus, the root of the original equation is obtained in the form of a continued product. After applying this method to finding a root of an equation of the 4th, and likewise one of the 5th degree, the author applies it to a class of equations to which he considers it peculiarly adapted, namely, those in which several terms are wanting. One of these is of the 16th degree, having only six terms; and another is of the 622nd degree, having only four terms.

3. "Additional Note on the Contraction of Voluntary Muscles in the living body." By William Bowman, Esq., F.R.S., Demonstrator of Anatomy in King's College, London, and Assistant Surgeon to King's College Hospital.

This communication contains a short account of some recent examinations made by the author on the human muscular fibre affected by tetanus. The effect of the violent contractions which characterize this disease, is to produce, in many parts of the muscles, considerable ecchymosis, which gives the contiguous portions a pale and gray aspect. In other places the muscles lose, in a great measure, their fine fibrous character, and exhibit a soft mottled surface, which is easily torn. The primitive fasciculi, when microscopically examined, present indications of strong contraction, appearing swollen into a fusiform shape, and having their transverse striæ in some parts much more closely approximated, and in others separated to much greater distances than in the natural state, or even altogether obliterated, in consequence of the whole texture being broken up into those primitive elements of which the discs are constructed; and frequently they are broken across without a corresponding rupture of the sarcolemma.

The author is led from his observations to the conclusions,—1st, that the contraction of a muscle is the essential cause of its rupture, 2ndly, that there is no repellent force between the contractile elements of muscular fibre; and, lastly, that the contraction of voluntary muscle is not a sustained act of the whole congeries of contractile elements composing it, but a rapid series of partial acts, in which all duly share, becoming by turns contracted and relaxed.

The paper is accompanied by drawings of the microscopic appearances therein described.

May 6, 1841.

Sir JOHN W. LUBBOCK, Bart., V.P. and Treas., in the Chair.

The Right Honourable George Stevens Byng, M.P., was balloted for and duly elected into the Society.

The following papers were read, viz.—

1. "Investigation of a New and Simple Series, by which the Ratio of the Diameter of a Circle to its Circumference may easily be computed to any required degree of accuracy." By William Rutherford, Esq., of the Royal Military Academy, Woolwich. Communicated by Samuel Hunter Christie, Esq., M.A., Sec. R.S.

Among various formulæ for the rectification of the circle discovered by the author, he has found the one given in this paper to be that best fitted for computation: and he has been enabled by means of it, with comparatively little labour, to extend the number, expressing the ratio of the diameter to the circumference, to 208 places of decimals, a degree of accuracy hitherto unattainable, without a great amount of labour, by means of any of the series which have yet been employed.

The celebrated series of Mr. John Machin, for the rectification of the circle, is derived from the formula

$$\frac{\pi}{4}=4\tan^{-1}\frac{1}{5}-\tan^{-1}\frac{1}{239},$$

which converges with considerable rapidity, but gives rise to tedious computations, in consequence of the divisor 239 being a prime number. But by converting the above formula into the following,

$$\frac{\pi}{4}=4\tan^{-1}\frac{1}{5}-\tan^{-1}\frac{1}{70}+\tan\frac{1}{99},$$

a series is obtained by which the extended computation above mentioned was readily effected.

The methods of computation are then stated in detail, and the resulting value of π is given to 208 places of decimals, which is presumed to be accurate to the last figure, the computations having been actually carried as far as 210 figures.

2. "On the Phenomena of thin plates of Solid and Fluid Substances exposed to polarised light." By Sir David Brewster, K.H., D.C.L., F.R.S., & V.P.R.S. Ed.

From a theoretical investigation of the phenomena described in this paper, the author deduces the important law, that when two polarized pencils, reflected from the surface of a thin plate, lying on a reflecting surface of a different refractive power, interfere, half an undulation is not lost, and white-centred rings are produced. When the inclination is exactly 90°, the pencils do not interfere, and no rings are produced.